

WHAT IS CLAIMED IS:

1. An optical connector plug for connecting an optical cord having an optical fiber, an coated optical fiber  
5 having an optical fiber coat covering the optical fiber, a cord outer jacket further covering said coated optical fiber and a tension resistive member disposed between said coated optical fiber and said cord outer jacket, said optical connector plug comprising at least;
- 10 a front housing arranged on a front side in an optical axis direction;
- a rear housing coupled to said front housing and arranged on a rear side of said front housing in the optical axis direction;
- 15 a ferrule;
- a coil spring; and
- an optical cord fixing member;
- wherein said ferrule is constructed with at least an optical fiber positioning and fixing portion for fixing  
20 and positioning the optical fiber of said optical cord and a flange portion contacting with said coil spring within said front housing and biased by the latter and held;
- wherein said coil spring has a tip end portion contacting said flange portion of said ferrule for biasing  
25 the latter, and a rear end portion for contacting with said rear housing, said coil spring having predetermined inner and outer diameters;

wherein said optical cord fixing member is a member constructed with one or more members and has a fixing structure of said optical cord depending upon a structure of said optical cord to be used, said optical cord fixing member, at least after the optical cord is assembled and fixed thereto, having a circumscribing circle smaller than a predetermined diameter and an inscribing diameter greater than an outer diameter of said optical cord, and having engaging means for engaging with an inner

peripheral surface of said rear housing at least on a part of an outer peripheral surface thereof;

wherein said front housing is a member constructed with one or more members including coupling means for coupling to said rear housing, and a through hole, said through hole including a hole portion having an inner peripheral surface greater than an outer shape of said optical fiber positioning and fixing portion for projecting said optical fiber positioning and fixing portion of said ferrule at least at a tip end, a flange portion holding portion formed continuously with said hole portion and having a ferrule<sup>112</sup> flying out preventing structure partly interfering with said flange portion of said ferrule, and a rear through hole portion having an inscribing circle greater than the outer diameter of said coil spring;

wherein said rear housing is a member constructed with one or more members having at least engaging means for

coupling with said front housing, and a through hole, said engaging means having a structure for coupling said front housing and said rear housing by moving said rear housing frontward, on a rear end side of said through hole being  
5 formed with a fiber insertion hole having an inner diameter greater than the outer diameter of said optical cord and smaller than an inscribing circle of said optical cord fixing member, an optical cord fixing member holding portion being formed in front of said fiber insertion hole  
10 following thereto and having a greater hole shape than said fiber insertion hole and having fixing means, having an internal space greater than said optical cord fixing member, for holding and fixing said optical cord fixing member, on a tip end side of said through hole a coil spring  
15 holding portion for holding said coil spring and biasing the rear end of said coil spring being formed, and an optical cord fixing member introducing hole being formed between said coil spring holding portion and the optical cord fixing member holding portion, as a through opening  
20 having an internal peripheral shape greater than a sectional shape taken along a plane perpendicular to an axis of said optical cord fixing member; and

wherein in a condition where said front housing and said rear housing are coupled to each other, a through space  
25 portion is defined therein, and the through space portion is defined such that said ferrule, to which the optical fiber of said optical cord is fixed, is held in a condition

where a tip end of said optical fiber positioning and fixing portion of said ferrule is extended from the tip end of said front housing, said flange portion is arranged with restriction of position in the axial direction by said ferrule flying out preventing structure, and said flange portion of said ferrule is biased frontward by the tip end of said coil spring, said coil spring is biased frontward by the coil spring holding portion of said rear housing, and said optical cord fixing member, to which said optical cord is fixed, is fixed and held in said optical cord fixing member holding portion of said rear housing.

2. An optical connector plug as claimed in claim 1, wherein said optical cord fixing member has a clamp seat and a clamp ring,

said clamp seat is a member having a through hole having an inscribing circle greater than the outer diameter of said coated optical fiber and being formed with a tension resistance member fixing portion,

said clamp ring is a member having a through hole with an inscribing circle greater than an outer diameter of said tension resistive member fixing portion of said clamp seat, and being formed with a tension resistive member fixing portion and a cord outer jacket fixing portion therein,

after passing said coated optical fiber through said clamp seat and shifting the clamp seat to an end portion of exposed cord outer jacket, by placing an exposed tension

resistive member along said tension resistive member  
fixing portion of said clamp seat, fitting said clamp ring  
over said clamp seat, along which said tension resistive  
member is placed, and the end portion of said cord outer  
5 jacket so as to cover them,

and then clamping said tension resistive member fixing  
portion and said cord outer jacket fixing portion of said  
clamp ring, said tension resistive member and said cord  
outer jacket is fixed to said clamp seat and said clamp  
10 ring.

3. An optical connector plug as claimed in claim 1,  
wherein a fixing portion for fixing the tension resistive  
member by bonding is formed on the outer peripheral portion  
15 of said optical cord fixing member, and said tension  
resistive member is fixed to said optical cord fixing  
member by an adhesive.

4. An optical connector plug as claimed in any one of  
20 claims 1 to 3, wherein at least a part of said optical cord  
fixing member has a polygonal outer shape in section with  
a chamfered round corner, and a rotation preventing  
structure is formed in such a manner that at least a part  
of a receiving portion for said optical cord fixing member  
25 in said rear housing as a part of an inner shape of said  
optical cord fixing member holding portion of said rear  
housing has a substantially circular sectional shape of

substantially the same size as a circumscribing circle of the polygonal optical cord fixing member with the chamfered round corner and more specifically has a surface by cutting out a part of said substantially circular shape so as to hold the optical cord fixing member to be rotatable within a predetermined angular range.

5. An optical connector plug as claimed in claim 4, wherein a fixing member rotation restricting portion for restricting a rotation of the optical cord fixing member is provided in a through hole portion on opposite side of the through hole to the optical cord insertion hole, the through hole being communicated with said optical cord fixing member holding portion of said rear housing, said fixing member rotation restricting portion has a substantially circular inner shape with a surface cut out partially on the rear end side and an inner shape continuous with the circumscribing circle of said optical cord fixing member on the tip end side, and an inner shape at an intermediate portion located between the rear end side and the tip end side is a shape forming transition between two inner shapes.

6. An optical connector plug as claimed in any one of claims 1 to 5, wherein a projecting portion is provided on the inner peripheral surface of the optical cord fixing member holding portion of the rear housing, when the

optical cord fixing member is received within the hole of the optical cord fixing member holding portion, the optical cord fixing member is fixed in the rear housing by interference caused between said projecting portion and  
5 an outer peripheral surface of said optical cord fixing member.

7. An optical connector plug as claimed in any one of claims 1 to 6, wherein a shape of an inner peripheral  
10 surface of the coil spring holding portion of said rear housing is substantially the same as a shape of the outer shape of said coil spring, and a projecting portion is provided on the inner peripheral surface for fixing said coil spring in the rear housing by interference between  
15 the outer surface of said coil spring and said projecting portion when said coil spring is received within said coil spring holding portion.

8. An optical connector plug as claimed in any one of  
20 claims 1 to 7, wherein engaging means of said rear housing and said front housing is a structure formed with a cantilever provided in one of said rear and front housings and including an engaging projection at a tip end thereof, and an engaging hole provided in the other of said rear  
25 and front housings and adapted to receive said engaging projection.

9. An optical connector plug as claimed in any one of claims 1 to 8, wherein said rear housing includes a rear housing body and a boot to be coupled with a rear portion of said rear housing body, and said rear housing body and  
5 said boot are preliminarily integrated with each other.

10. An optical connector plug as claimed in any one of claims 1 to 9, wherein said front housing is formed with a front housing body and a finger grip covering the front  
10 housing body, and said front housing body and said finger grip are preliminarily integrated in a slidable fashion.

11. An optical connector plug as claimed in any one of claims 1 to 10, wherein said optical cord fixing member  
15 is a member having a circumscribing circle smaller than an inner diameter of said coil spring at least after assembling said optical cord and said tension resistive member and said cord outer jacket are fixed to said optical cord fixing member.

20

12. An optical connector plug as claimed in claim 1, wherein said optical cord fixing member has a substantially polygonal shape in section, a substantially planar wall surface for restricting rotation of said  
25 polygonal shape optical cord fixing member is formed at one or more positions on the inner peripheral surface of the hole of said optical cord fixing member holding portion



of said rear housing.

13. An optical connector plug as claimed in claim 12, a rotation restricting portion for restricting rotation of said optical cord fixing member is formed on an inner peripheral surface of a portion continuous with said optical cord fixing member holding portion in said optical cord fixing member introducing hole of said rear housing, said restricting portion continuously increases in height and restricting area toward rearward, and continuous with the substantially planar wall surface formed on the inner peripheral surface of the hole of said optical cord fixing member holding portion.

14. An optical connector plug, comprising:  
a front housing, a rear housing to be coupled with said front housing, a ferrule, a coil spring, and an optical cord fixing member, and connecting an optical cord including a coated optical fiber having an optical fiber and an optical fiber coat covering the optical fiber, a cord outer jacket further covering said coated optical fiber and a tension resistive member disposed between said coated optical fiber and said cord outer jacket,

wherein said ferrule has an optical fiber positioning and fixing portion for positioning and fixing the optical fiber at a tip end of the coated optical fiber of said optical cord and a flange portion contacting with said coil

spring and biased thereby,

wherein said coil spring has a tip end portion for contacting with said flange portion of said ferrule and biasing the latter, and a rear end portion for contacting  
5 with said rear housing, said coil spring having predetermined inner and outer diameters,

wherein said optical cord fixing member has an outer diameter capable of insertion into said coil spring and an inner diameter permitting insertion of said optical  
10 cord, when said optical cord is fixed thereto, and engaging means for engaging with said rear housing at least on a part of an outer peripheral surface,

wherein said front housing includes engaging means for engaging with said rear housing, and a first through  
15 hole, said first through hole comprising a tip end side hole portion having an inner diameter greater than an outer diameter of said optical fiber positioning and fixing portion of said ferrule, an intermediate hole portion continuous with said tip end side hole portion, and  
20 a flange portion holding portion for restricting frontward movement of the flange portion of said ferrule and receiving said flange portion, and a rear side hole portion having an inner diameter greater than an outer diameter of said coil spring,

25 wherein said rear housing includes engaging means for engaging with said engaging means of said front housing by relatively moving said rear housing and said front

housing toward each other, and a second through hole, on a rear end side of said second through hole, an optical cord inserting hole having an inner diameter permitting insertion of said optical cord but not permitting

5 insertion of said optical cord fixing member is formed, in front of said optical cord insertion hole, an optical cord fixing member holding hole having fixing means for fixing said optical cord fixing member and receiving said optical cord fixing member is formed continuous with said  
10 optical cord insertion hole, on a tip end side of said second through hole, a coil spring holding portion for holding said coil spring and biasing the rear end of said coil spring is formed, and between said coil spring holding portion and said optical cord fixing member holding hole,  
15 an optical cord fixing member introducing hole for permitting insertion of said optical cord fixing member is formed,

wherein in a condition where said front housing and said rear housing are coupled with each other, a through  
20 space portion is defined therein, and

wherein said ferrule, said coil spring and said optical cord fixing member are received within said through space portion such that said ferrule is held in a condition where a tip end of said optical fiber  
25 positioning and fixing portion of said ferrule, to which the optical fiber of said optical cord is fixed, is extended from the tip end of said front housing, said flange portion

is restricted forward movement by the flange portion holding portion of the front housing and is biased frontward by said coil spring, said coil spring is biased frontward by the coil spring holding portion of said rear housing, and said optical cord fixing member, to which said optical cord is fixed, is fixed and held by said optical cord fixing member holding hole of said rear housing.

15. A manufacturing method of an optical connector plug for connecting the optical connector plug with an optical cord including a coated optical fiber having an optical fiber and an optical fiber coat covering the optical fiber, a cord outer jacket further covering the coated optical fiber and a tension resistive member disposed between said coated optical fiber and said cord outer jacket, said method comprising:

a first step of passing said optical cord through a rear housing and a coil spring;

a second step of exposing the coated optical fiber and the tension resistive member at an end portion of said optical cord;

a third step of fixing an optical cord fixing member to said optical cord by fixing said tension resistive member and said cord outer jacket by said optical cord fixing member;

a fourth step of forming a cord pre-assembly part, in which said optical cord fixing member and a ferrule are

fixed, by fixing said ferrule to a tip end of said coated optical fiber such that a relative spaced distance to said fixed optical cord fixing member becomes a preliminarily set predetermined distance; and

5 a fifth step of coupling a front housing and the rear housing by movement in back and forth directions for accommodating said cord pre-assembly part and said coil spring.

10 16. A manufacturing method of an optical connector plug as claimed in claim 15, wherein in said fourth step, said ferrule is fixed to the tip end of said coated optical fiber such that said ferrule is spaced apart from the optical cord fixing member by a relative spaced distance  
15 corresponding to that in a condition where said ferrule and said coil spring is held within a through space portion defined inside when said front housing and said rear housing are coupled, with a flange portion of said ferrule being biased frontward by said coil spring, and said  
20 optical cord fixing member is held within an optical cord fixing member holding hole of said rear housing with said coil spring being biased frontward by the coil spring holding portion of said rear housing.

25 17. A manufacturing method of an optical connector plug as claimed in claim 15 or 16, wherein, in said fourth step, a process including face polishing of an end face of said

ferrule is performed.

18. A manufacturing method of an optical connector plug for connecting the optical connector plug with an optical cord including a coated optical fiber having an optical fiber and an optical fiber coat covering the optical fiber, a cord outer jacket further covering the coated optical fiber and a tension resistive member disposed between said coated optical fiber and said cord outer jacket, said method comprising:

a first step of passing said optical cord through a rear housing and a coil spring;

a second step of exposing the coated optical fiber and the tension resistive member at an end portion of said optical cord;

a third step of fixing a ferrule at a tip end of the coated optical fiber;

a fourth step of forming a cord pre-assembly part, in which an optical cord fixing member and the ferrule are fixed, by fixing an optical cord fixing member to said optical cord by fixing said tension resistive member and said cord outer jacket by said optical cord fixing member such that a relative spaced distance to said fixed ferrule becomes a preliminarily set predetermined distance; and

a fifth step of coupling a front housing and the rear housing by movement in back and forth directions for accommodating said cord pre-assembly part and said coil

spring.

19. A manufacturing method of an optical connector plug  
as claimed in claim 18, wherein in said fourth step, said  
5 ferrule is fixed to the tip end of said coated optical fiber  
such that said ferrule is spaced apart from the optical  
cord fixing member by a relative spaced distance  
corresponding to that in a condition where said ferrule  
and said coil spring is held within a through space portion  
10 defined inside when said front housing and said rear  
housing are coupled, with a flange portion of said ferrule  
being biased frontward by said coil spring, and said  
optical cord fixing member is held within an optical cord  
fixing member holding hole of said rear housing with said  
15 coil spring being biased frontward by the coil spring  
holding portion of said rear housing.

20. A manufacturing method of an optical connector plug  
as claimed in claim 18 or 19, wherein, in said third step,  
20 a process including face polishing of an end face of said  
ferrule is performed.

21. A manufacturing method of an optical connector plug  
as claimed in claim 18 or 19, wherein, in said fourth step,  
25 a process including face polishing of an end face of said  
ferrule is performed.

22. An assembling tool of an optical connector plug for use upon fixing a ferrule and an optical cord fixing member to an optical cord including a coated optical fiber having an optical fiber and an optical fiber coat covering the optical fiber, a cord outer jacket further covering the coated optical fiber and a tension resistive member disposed between said coated optical fiber and said cord outer jacket, such that said ferrule and said optical cord fixing member are spaced apart by a predetermined distance, said assembling tool comprising:

optical cord fixing member holding means for holding said optical cord fixing member fixing the tension resistive member and the cord outer jacket of said optical cord;

ferrule holding means for positioning and holding said ferrule so that said ferrule is spaced apart from said optical cord fixing member held by said optical cord fixing member holding means by a distance corresponding to said predetermined distance; and

wherein said optical fiber of said optical cord is fixed by bonding to said ferrule held by said ferrule holding means.

23. An assembling tool of an optical connector plug for use upon fixing a ferrule and an optical cord fixing member to an optical cord including a coated optical fiber having an optical fiber and an optical fiber coat covering the



optical fiber, a cord outer jacket further covering the coated optical fiber and a tension resistive member disposed between said coated optical fiber and said cord outer jacket, such that said ferrule and said optical cord fixing member are spaced apart by a predetermined distance, said assembling tool comprising:

ferrule holding means for holding the ferrule to which the optical fiber of said optical cord is fixed by bonding;

optical cord fixing member holding means for positioning and holding said optical cord fixing member so that said optical cord fixing member is spaced apart from said ferrule held by said ferrule holding means by a distance corresponding to said predetermined distance; and

wherein said tension resistive member and said cord outer jacket of said optical cord is processed to be fixed to said optical cord fixing member held by said optical cord fixing member holding means.

24. An assembling tool of an optical connector plug for use upon assembling said optical connector plug with an optical cord using a cord pre-assembly part, in which a ferrule and an optical cord fixing member fixing said optical cord are fixed so as to be spaced apart by a predetermined spaced distance, said optical cord including a coated optical fiber having an optical fiber and an optical fiber coat covering the optical fiber, a

cord outer jacket further covering the coated optical fiber and a tension resistive member disposed between said coated optical fiber and said cord outer jacket. , said assembling tool comprising:

5 front housing holding means for holding a front housing on a front side of said ferrule of said cord pre-assembly part;

assembly holding means for holding the ferrule or the optical cord fixing member of said cord pre-assembly part;

10 rear housing holding means, movable in back and forth directions, for holding a rear housing, through which said optical cord of said cord pre-assembly part is inserted, and provided with a coil spring, on a rear side of said optical cord fixing member of said cord pre-assembly part;

15 frictional resistance applying means for applying a frictional resistance force to said optical cord on a back side of said rear housing holding means; and

wherein said rear housing is coupled with said front housing in a condition accommodating said ferrule, said  
20 optical cord fixing member and said coil spring by frontward movement of said rear housing holding means.

25. An assembling tool of an optical connector plug for use upon assembling said optical connector plug with an  
25 optical cord using a cord pre-assembly part, in which a ferrule and an optical cord fixing member fixing said optical cord are fixed so as to be spaced apart by a

predetermined spaced distance, said optical cord including a coated optical fiber having an optical fiber and an optical fiber coat covering the optical fiber, a cord outer jacket further covering the coated optical fiber and a tension resistive member disposed between said  
5 coated optical fiber and said cord outer jacket, said assembling tool comprising: assembly holding means for holding the ferrule or the optical cord fixing member of said cord pre-assembly part;

10 rear housing holding means for holding a rear housing, through which said optical cord of said cord pre-assembly part is inserted, and provided with a coil spring, on a rear side of said optical cord fixing member of said cord pre-assembly part;

15 cord pulling means for pulling said optical cord on a rear side of said rear housing holding means;

front housing holding means, movable in back and forth directions, for holding a front housing on a front side of said ferrule of said cord pre-assembly part; and

20 wherein said front housing is engaged with said rear housing in the condition accommodating said ferrule, said optical cord fixing member and said coil spring by moving said front housing holding means backward and pulling and moving said optical cord backward by said cord pulling  
25 means.

26. An optical connector plug to be connected to an end

portion of an optical cord having an coated optical fiber including an optical fiber and an optical fiber coat covering said optical fiber, a cord outer jacket further covering said coated optical fiber and a tension resistive member disposed between said coated optical fiber and said cord outer jacket, said optical connector plug comprising:

a ferrule having a flange portion and fixing an optical fiber exposed at a terminal end of said optical cord;

an optical cord fixing member for fixing an exposed tension resistive member and said cord outer jacket of said optical cord on a rear side of said ferrule;

a coil spring capable of insertion of said optical cord and contacting with a flange portion of said ferrule at a tip end thereof;

a front housing having a through hole and a holding portion for holding the ferrule loaded in the through hole inside of the housing in such a manner that a tip end of said ferrule projects from a front face opening;

a rear housing including a through hole, a spring engaging portion for engaging with a rear portion of said coil spring loaded on a front side of said through hole, and an optical cord fixing member engaging portion engaging with said optical cord fixing member to be inserted up to a rear portion of said through hole from a front side, and

wherein said optical cord fixing member is provided

with an external dimension capable of passing through  
inside of said coil spring and being accommodated in said  
rear housing,

and said ferrule, said coil spring and said optical cord  
5 fixing member are received and secured within a space  
defined by engaging said front housing and said rear  
housing.